# Grower Handling of Red Cherries



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**Circular No. 981**
May 1956

UNITED STATES DEPARTMENT OF AGRICULTURE
*In cooperation with*
The Agricultural Experiment Station of Michigan State University

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## ACKNOWLEDGMENTS


The authors wish to express their appreciation to the Michigan Fruit Canners Inc., Fennville, Mich.; Oceana Canning Co., Shelby, Mich.; Cherry Growers, Inc., Traverse City, Mich.; Floyd Cargill Orchards, Hart, Mich.; and Circle Three Orchards, Fremont, Mich., for their cooperation in the studies reported here.



Washington, D. C. Issued May 1956

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. - Price 15 cents

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United States Department of Agriculture in cooperation with the Agricultural Experiment Station of Michigan State University

## SUMMARY AND CONCLUSIONS

The red cherry crop has been handled in lugs by hand for many years. In 1951, research workers of the United States Department of Agriculture and the Michigan State Agricultural Experiment Station, in a cooperative study, devised a method of handling cherries in lugs with forklift trucks. As compared with the conventional hand method, the forklift method saves time, labor, and money; reduces bruising and spillage; and reduces congestion and lug breakage.

In 1952, the same research workers began studies which led to the development of a method of handling cherries in water at the receiving station. Results obtained in these studies suggested that it might be more advantageous to handle the cherries in water at the orchard, and studies conducted in 1954 led to the development of this method. Results of both these studies are reported in this publication.

The studies showed that handling cherries in water at the orchard:

1. Helps maintain on-the-tree quality.
2. Provides a means of improving grade by orchard sorting.
3. Reduces costs of handling.
4. Eliminates lugs and lug storage, maintenance, distribution, and accounting problems.
5. Simplifies management.
6. Is commercially feasible.

## THE RED CHERRY INDUSTRY IS IMPORTANT

During the past decade, growers of red cherries in the United States have received an average of more than $20 million annually for their crop.[1]

[1] United States Department of Agriculture. AGRICULTURAL STATISTICS, 1954, 607 pp. 1954.

In Michigan, which leads all other States in production, the average annual return to growers for the 10-year period 1945–54 was in excess of $10 million.[2] This return to growers for red cherries was more than for any other fruit or vegetable produced.

Red cherries are also of major economic importance in New York, Wisconsin, and Pennsylvania; and commercial cherry crops of considerable value are grown in Washington, Colorado, Ohio, Utah, and Oregon.

## PRODUCTION IS INCREASING RAPIDLY

Production of red cherries in the United States has been increasing steadily for more than 30 years. From 1940 to 1955, average annual production increased from 79,000 to 140,000 tons (fig. 1). The average rate of increase for this 15-year period exceeded 4,000 tons per year.

The higher prices received for cherries during the last few years have accelerated the planting of new orchards. More productive strains, better spray chemicals, and improved cultural practices are increasing per-acre yields. These facts probably mean that the upward trend in production will continue during the next several years.

Projecting the calculated rate of increase to 1960 indicates that normal production in the United States in 1960 will be approximately 160,000 tons. Production in any given year, however, may exceed the average, as in 1946, 1948, 1950, 1951, and 1955. Under favorable conditions, it is conceivable that a crop of 200,000 tons of red cherries might be produced in 1960.

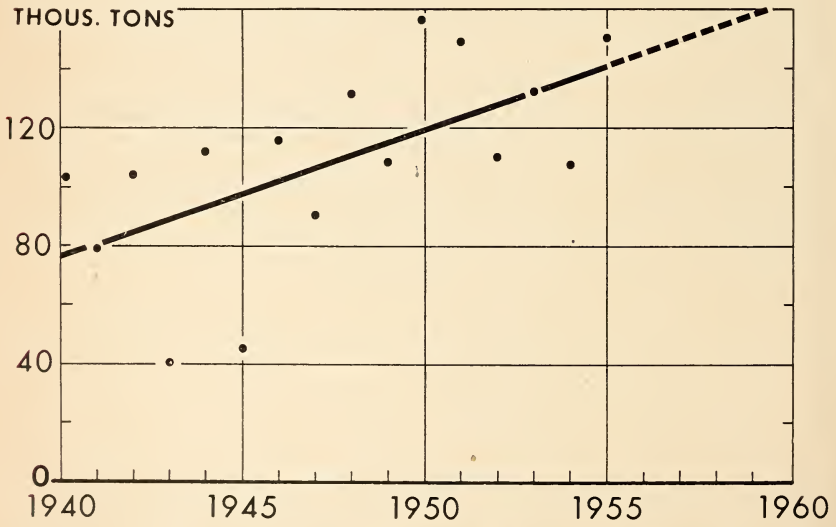


*Figure 1.*—Production of red cherries "having value" in the United States, 1940–55, inclusive. ("Having value" excludes fruit not harvested on account of economic conditions and/or excess cullage of harvested fruit. Curve plotted by least-squares method; data from U. S. Dept. Agr., Agricultural Statistics, 1954.)

[2] Michigan Department of Agriculture. MICHIGAN AGRICULTURAL STATISTICS 1954, 40 pp. 1955.

## MOST OF THE CROP IS PROCESSED

In recent years, more than 90 percent of the red cherry crop has been either canned or frozen.[3] Fewer than 100 processors are involved. Because the number of processors is small and all cherry growers can be reached through them, improved techniques can easily be brought to the attention of growers.

The cherry crop tends to move through the same channels and in the same way year after year. Because of this tendency for methods of handling to become standardized, improved methods could be put into widescale use on short notice.

## FIVE STEPS REQUIRED TO GET THE CHERRIES TO THE CONSUMER

Before red cherries reach the consumer, they must be:

1. Grown
2. Harvested (picked)
3. Handled
4. Processed (canned or frozen)
5. Distributed

The first two steps (growing and harvesting) are the responsibility of the grower. His income depends more or less directly on how well he performs these two steps. Most growers, therefore, are quick to adopt improved techniques, cultural practices, and machines. As a result, when weather conditions are favorable, the grower usually is able to produce high yields of good-quality fruit.

The fourth and fifth steps (processing and distribution) are the responsibility of the processor. His income depends directly on the efficiency with which these operations are performed. Most processors are interested in better canning and freezing techniques and better methods of distribution.

Before the harvested cherries can be processed and distributed, the fruit must be assembled and moved from the orchard to the processing plant. In the discussion that follows, this important third step is referred to as handling.

In the conventional method of handling, the processor furnishes the lugs in which the cherries are moved from the orchard, but the grower retains title to the fruit until he has delivered it to the processor—either at a receiving station or at the processing plant. (Receiving stations are operated by processors for the purpose of assembling cherries grown in areas considerable distances from the processing plant.)

If the grower delivers the cherries to the processing plant, the processor takes title to the fruit at the plant. But if the grower delivers the cherries to a receiving station, the processor takes title at that point even though it may be some distance from the processing plant.

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[3] United States Department of Agriculture. AGRICULTURAL STATISTICS, 1954, 607 pp. 1954.

Under these circumstances, many growers feel that the entire handling operation is the responsibility of the processor. Most processors maintain, however, that the grower should bear the responsibility of delivering the cherries to the receiving platform in good condition, whether the platform is at the receiving station or at the processing plant.

Because this situation has existed, the third step (handling) has received relatively little attention.

## HANDLING IS IMPORTANT TO BOTH GROWER AND PROCESSOR

Well-grown cherries usually possess high quality and attractive appearance as they hang on the tree at harvesttime. Unfortunately, they often deteriorate in both quality and appearance between the time they are picked and the time they arrive at the processing plant.

Handling adds nothing to the value of the cherries. A time-consuming inefficient method of handling tends to increase costs. High costs usually mean that both the grower and the processor make less profit or that the consumer pays more, or both.

In a normal year, approximately 125,000 tons of red cherries move to fewer than 100 processors in a period of 4 to 5 weeks. In handling a perishable crop like cherries, time is a limiting factor. It has been found that, so far as quality is concerned, the most critical period is the first 4 hours after the fruit is picked. Inefficient handling during this period causes irreparable damage. The undergrade fruit that develops must be sorted out, or the pack will be of inferior quality. In either case, potential returns are reduced. Therefore, once harvesting has started, it is to the advantage of the grower to complete the job quickly and without delay. He should employ a method of handling that will keep the flow of fruit moving smoothly.

If the processor is to sell the tonnage that is in prospect at a price that will return a profit to himself and to the growers who supply him, he must put up a quality pack at a minimum cost. He cannot do this unless the fruit is handled rapidly and efficiently both before and after it reaches the processing plant.

A good method of handling should:

1. Help maintain on-the-tree quality.
2. Be relatively inexpensive.
3. Be relatively simple and practical.
4. Benefit both grower and producer.

## HANDLING CHERRIES IN LUGS—BY HAND

Cherries have been handled in lugs by hand for many years. Until recently, this was the only method of handling in common use. In this method, the picker usually puts the fruit into 10-quart pails as he harvests it. In most orchards, the picker pours the cherries from the pails into lugs (which hold from 25 to 35 pounds of fruit) and checks in the filled lugs. However, in some orchards, the picker checks in the pails of cherries and the grower, or someone in his employ, fills the lugs. In either case, the lugs are filled near the point in the orchard where the cherries are picked.

*Figure 2.*—Transferring filled cherry lugs from an orchard trailer to the grower's truck by hand. This is hard, time-consuming labor.

After the lugs are filled, they are stockpiled in the orchard until enough have accumulated to load an orchard trailer (or truck). When the trailer is loaded, it is moved to a point where the lugs can be transferred to the grower's truck (fig. 2). When the truck is loaded, it is sent either to a receiving station, if the processor operates one, or direct to the processing plant.

If the grower delivers the cherries to a receiving station, the lugs are transferred from the grower's truck to the processor's truck, if one is available, and then moved to the processing plant (fig. 3). If the processor does not have a truck immediately available, the lugs usually must be stockpiled until one becomes available. In either case, the grower receives empty lugs in exchange for those he delivers. These must be loaded on his truck for the return trip to the orchard.

When the truck arrives at the processing plant (whether it is the grower's truck direct from the orchard or the processor's truck from the receiving station), the lugs are unloaded and emptied into a hopper, from which the cherries move into soak tanks. From the soak tanks, they move into the processing line.

The truck is reloaded with empty lugs for the return trip to the orchard (or receiving station). On arrival, the lugs are unloaded from the truck and stockpiled until they are needed.

Handling cherries in lugs by hand is inefficient for the following reasons:

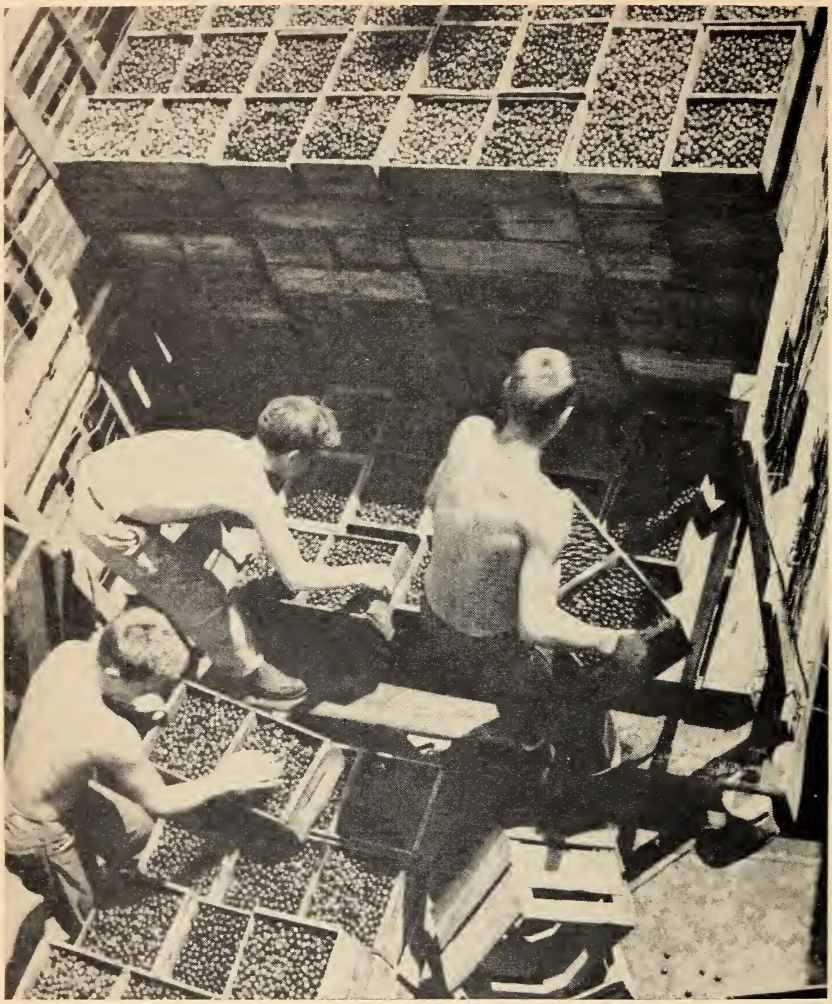

*Figure 3.*—Loading filled cherry lugs at a receiving station by hand. It took 3 men more than 2 hours to load this truck for movement to the processing plant.

**On-the-tree quality is difficult to maintain.**—When cherries are handled in lugs by hand, delays and congestion are almost inevitable. Several hours usually elapse between the time the fruit is picked and the time it arrives at the processing plant. During some of this period, the lugs of cherries often are stacked in tiers in the hot summer sun. The heat developed by respiration increases the temperature of the fruit. The amount of scald and fungus that develops in cherries increases rapidly as the temperature rises and the holding time is extended.

Some spillage occurs in most handling operations. When the cherries are handled in lugs by hand, spillage losses usually are considerable. Also, repeated handlings tend to increase the amount of bruising.

Delays, high temperature, and bruising result in the lowering of quality.

**Investment in lugs is high.**—More than a million lugs are required to handle the red cherry crop. At the current price of approximately 50 cents each, processors have more than $500,000 invested in lugs. When the cherry crop is handled in lugs by hand, breakage of lugs is high; lug mortality often amounts to 10 percent annually. This means that in addition to their $500,000 investment in lugs, processors spend approximately $50,000 a year replacing those that are damaged beyond repair. They must also pay maintenance and storage costs on the lugs.

During the round trip from the orchard to the processing plant a single lug may be lifted, moved, and stacked as many as a dozen times. Each lug makes many round trips during a season. Handling these lugs by hand takes time and costs money.

**Management is difficult.**—An orderly harvest depends on the continuous flow of lugs from grower to processor and back to grower. This movement of lugs results in difficult transportation, accounting, maintenance, and distribution problems. A large labor force is required to handle the great number of lugs. The recruitment and supervision of such a force during the relatively short season presents serious problems.

## HANDLING CHERRIES IN LUGS—WITH FORKLIFT TRUCKS

The difficulties of handling fruit in lugs by hand have been recognized for many years. It was not until 1951, however, that a new handling method was devised. It was at this time that fruitgrowers began to use forklift trucks. Experimental work conducted in Michigan in 1951 [4] proved conclusively that cherries could be handled to good advantage with forklift trucks.

In this method of handling, the cherries are picked in pails and poured into lugs in the conventional manner. The filled lugs are then loaded onto orchard trailers, which have been provided with pallets. The lugs are stacked in such a way that a pallet and the lugs piled on it can be handled as a unit load. As many as 50 lugs can be stacked on a pallet.

The loaded orchard trailer is moved to a surfaced area in or near the orchard where a forklift truck can be used to lift the loaded pallets off the trailer (fig. 4). The pallets are either loaded onto an outgoing truck, or stockpiled.

If the processor has a forklift truck available at his receiving station (or processing plant), it can be used to remove the loaded pallets from the truck (fig. 5). Empty lugs can also be handled on pallets at the receiving station and processing plant, and again on arrival at the orchard.

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[4] Levin, J. H., and Gaston, H. P., FRUIT HANDLING WITH FORK LIFT TRUCKS. Mich. Agr. Expt. Sta. Spec. Bul. 379, 25 pp., illus. 1952.

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*Figure 4.*—Filled cherry lugs being lifted off an orchard trailer and reloaded onto a road truck by means of a forklift truck.

*Figure 5.*—Filled cherry lugs being unloaded at the processing plant by means of a forklift truck.

The Michigan studies showed that handling cherries in lugs with a forklift truck has the following advantages over the conventional hand method:

**Saves time.**—In a typical case, a crew of 3 men took four times as long to unload cherries from orchard trailers by hand as was required for 1 man with a forklift truck to do the same job (table 1). A comparison of man-hours in this operation shows that the performance ratio was 12 to 1.

TABLE 1.—*Comparison of labor and time required and cost of labor for handling red cherries in lugs by hand and with a forklift truck*

| Method of handling, and handling operation | Lugs handled | Men in crew | Time required for crew to handle 100 lugs | | Labor cost per 100 lugs handled |
|---|---|---|---|---|---|
| | *Number* | *Number* | *Minutes* | *Man-minutes* | *Cents* |
| By hand: | | | | | |
| Unloading filled lugs from orchard trailer | 3, 670 | 3 | 9. 6 | 28. 8 | 48. 0 |
| Moving filled lugs 30 feet and stacking them [1] | 1, 340 | 2 | 12. 6 | 25. 2 | 42. 0 |
| Loading trucks with filled lugs | 2, 100 | 3 | 11. 3 | 33. 9 | 56. 5 |
| Unloading filled lugs from truck | 3, 320 | 3 | 9. 9 | 29. 7 | 49. 8 |
| Moving empty lugs onto or off truck | 2, 680 | 3 | 3. 2 | 9. 6 | 15. 8 |
| With forklift truck: | | | | | |
| Unloading filled lugs from orchard trailer | 1, 200 | 1 | 2. 4 | 2. 4 | 4. 0 |
| Moving filled lugs 30 feet and stacking them | 576 | 1 | 1. 6 | 1. 6 | 2. 6 |
| Loading trucks with filled lugs | 1, 758 | 1 | 2. 8 | 2. 8 | 4. 7 |
| Unloading filled lugs from truck | 3, 650 | 1 | 1. 9 | 1. 9 | 3. 1 |
| Moving empty lugs onto or off truck | 3, 010 | 1 | 2. 2 | 2. 2 | 3. 7 |

[1] With the aid of a roller conveyor.

**Saves labor.**—Use of a forklift truck saves labor as well as time (table 1). Lift trucks take much of the physical work out of fruit handling. Growers have found that it is much easier to get one good workman to operate a lift than it is to get several workmen to do the job by hand.

**Saves money.**—Use of a forklift truck reduces the cost of loading trucks with cherries by 51.8 cents per 100 lugs (table 1). Records kept on the cost of handling a 300-ton cherry crop showed that use of the lift saved the grower approximately 2¼ cents per lug of cherries harvested.

**Reduces bruising.**—When a number of lugs are moved as a unit load on a pallet, most if not all of the bruising that might otherwise have occurred is eliminated. Use of the lift not only reduces the

number of individual handlings, but also eliminates most of the damaging jolts to which the filled lugs would otherwise be subjected.

**Reduces congestion.**—Congestion at any point where fruit is loaded, unloaded, and handled usually causes damage and loss. The use of a lift is effective in keeping working areas clear and fruit moving rapidly.

**Reduces spillage.**—When lugs of cherries are handled individually and often, spillage losses usually are considerable. When lugs are handled as a unit load, spillage is reduced materially.

**Reduces lug breakage.**—When 50 or more lugs are stacked on a pallet and moved as a unit load, the handling of individual lugs is almost entirely eliminated. There is a corresponding reduction in the amount of breakage, the time and money spent in repairing broken lugs, and the cost of replacing those that are damaged beyond repair.

Although handling cherries with forklift trucks is an improvement over the conventional hand method, it provides only a partial solution to the handling problems. A large investment in lugs is still required. Losses due to high temperatures and scald are not entirely eliminated. Unless the lift is used for other crops, it is feasible only on relatively large operations (250 tons of cherries or more).

## THE "HYDROCOOLING AND TRANSPORTATION IN WATER" METHOD

Experiments were initiated in Michigan in 1952 to devise a still better method of handling cherries. These and subsequent trials led to the development of the "hydrocooling and transportation in water" method, which is rapidly coming into use.

In the initial experiments, the cherries were handled in lugs in the usual manner until they reached the receiving station. There they were poured from lugs into truck-mounted tanks of water for cooling and transportation to the processing plant. Later experiments carried this idea further by transferring the cherries from the picker's pails to the water tanks at the orchard, thus eliminating the use of lugs.

## HANDLING CHERRIES IN WATER—AT THE RECEIVING STATION

### Equipment

In this method of handling, the processor provides truck-mounted watertight tanks (fig. 6). Most processors remove the tanks from the trucks at the end of the cherry season and use the trucks for other purposes the rest of the year.

Experience has shown that open-top tanks are easier to load and service than closed tanks. If a closed tank is used, it should be equipped with several hatches of ample size.

The tank should be as light as possible without sacrificing rigidity and durability. In these experiments, tanks made of 13-gage sheet

*Figure 6.*—Tank trucks used by a Michigan processor to move cherries from receiving stations to the processing plant. A trial proved that these closed tanks were hard to load. Soon after this photograph was made, the hatches were removed and a 2′ x 14′ opening was cut into the top of each tank.

metal were usually suitable. The inside surface should be coated with some material (paint or enamel) that will not react chemically with the cherries.

The tank should be large enough so that the maximum legal load can be carried. (A cubic foot of capacity will hold approximately 48 pounds of cherries and 12 pounds of water.) The tank should not be more than 5 feet deep. The cherries near the bottom of the load may be crushed in a tank of greater depth.

The tank should be equipped with a system of pipes and valves which make it possible to introduce water through an inlet near the bottom of the tank, circulate it through the fruit, and allow it to overrun through an outlet near the top.

A 6-inch outlet should be provided near the bottom of the tank at a point that will facilitate unloading the cherries (fig. 7). In these experiments, sloping the bottom of the tank toward the outlet facilitated unloading, and this feature should be incorporated in the design.

The outlet should be equipped with a suitable valve. A flexible canvas tube the same diameter as the outlet can often be used to advantage as a valve. It must be firmly secured to the outlet and should be long enough to reach to the top of the tank. While the tank is being filled and during transit, the tube is hooked up in a vertical position. When the tank is being emptied, the tube is unhooked and lowered into a flume or "boot" at or below the level of the outlet. If desired, a "puckering string" can be placed near the end of the tube to regulate the flow of fruit.

The receiving station should have a supply of at least 20 gallons of cold water per minute, for use in filling the tanks and cooling the fruit. It is also necessary to provide a means of disposing of the overflow of water used during the cooling process.

*Figure 7.*—Cherries being flumed from a tank truck at the processing plant.

The processing plant should be equipped with a pump of suitable design or a movable flume for use in unloading the fruit. A water supply of at least 20 gallons per minute for use in fluming out the cherries and partially refilling the tanks is also necessary.

## Procedure

In this method of handling cherries in water at the receiving station, the first step is to fill the tank with cold water. Then the cherries are poured from the lugs into the water, and filling is continued until the cherries are within a few inches of the top of the tank.

As the tank is being filled with cherries, and after filling is completed, the intake valve at the bottom of the tank remains open so that cold water continues to circulate through the fruit and overrun at the top. The water that overflows carries away a considerable amount of dirt, leaves, stems, and defective cherries.

The flow of water is continued until the cherries have cooled to a temperature between 55° and 60° F. Then the intake valve is closed and the hose is disconnected. The water level is then lowered to about 6 inches below the top level of the fruit, and the "tanker" is started on its way to the processing plant.

On arrival at the plant, the cherries are flumed from the tank into a receiving hopper. From the hopper they move to soak tanks, and later they are processed in the usual manner.

## Results

In one experiment, detailed records were kept on 398,108 pounds of cherries handled in water at the receiving station and on 439,462 pounds handled in lugs by hand. An analysis of the data showed the following results:

**Quality.**—Data on refractometer readings, grade, scald, size, score, and drained weight of the processed fruit appear in tables 2 to 5.

TABLE 2.—*Refractometer readings of red cherries at the receiving station, at the processing plant, and after soaking, by method of handling* [1]

| Time of reading | Method of handling | |
|---|---|---|
| | Water-hauled | Lug-hauled |
| | °*Brix* | °*Brix* |
| At the receiving station | 15. 50 | 15. 50 |
| At the processing plant | 14. 60 | 15. 55 |
| Change from previous reading | −. 90 | +. 05 |
| After soaking | 14. 55 | 14. 75 |
| Change from previous reading | −. 05 | −. 80 |
| Change from initial reading | −. 95 | −. 75 |

[1] Readings were taken on the mixture resulting when random samples of 50 or more cherries were prepared in a Waring blendor.

TABLE 3.—*Grade of red cherries at the receiving station, at the processing plant, and after soaking, by method of handling* [1]

| Time of grading | Method of handling | |
|---|---|---|
| | Water-hauled | Lug-hauled |
| | *Grade* | *Grade* |
| At the receiving station | 92 | 92 |
| At the processing plant | 91. 31 | 90. 65 |
| Change from previous grade | −. 69 | −1. 35 |
| After soaking | 91. 96 | 90. 55 |
| Change from previous grade | +. 65 | −. 10 |
| Change from initial grade | −. 04 | −1. 45 |

[1] Federal-State standards were used in determining grades. The work was done by the investigators under the supervision of Federal-State inspectors.

TABLE 4.—*Percentage of red cherries showing scald at the receiving station, at the processing plant, and after soaking, by method of handling*

| Time of determination | Method of handling | |
|---|---|---|
| | Water-hauled | Lug-hauled |
| | *Percent* | *Percent* |
| At the receiving station | 5 | 5 |
| At the processing plant | 9. 55 | 16. 50 |
| Change from previous determination | +4. 55 | +11. 50 |
| After soaking | 15. 55 | 23. 30 |
| Change from previous determination | +6. 00 | +6. 80 |
| Change from initial determination | +10. 55 | +18. 30 |

TABLE 5.—*Average weight per cherry at the receiving station, at the processing plant, after soaking, and after pitting, by method of handling* [1]

| Time of weighing | Method of handling | |
|---|---|---|
| | Water-hauled | Lug-hauled |
| | *Grams* | *Grams* |
| At the receiving station | 3. 77 | 3. 77 |
| At the processing plant | 4. 04 | 3. 72 |
| Change in weight | +. 27 | −. 05 |
| After soaking | 4. 00 | 3. 79 |
| Change from previous weight | −. 04 | +. 07 |
| After pitting | 3. 26 | 3. 07 |
| Change from previous weight | −. 74 | −. 72 |
| Change from initial weight | −. 51 | −. 70 |

[1] Weight per cherry was obtained by counting the number of cherries per pound and converting the figures to grams per cherry.

The refractometer readings in table 2 show that, on the average, the total reduction in percentage of soluble solids that occurred during transportation and soaking was slightly greater in the water-hauled cherries than in the lug-hauled cherries. Whether this change is considered an asset or a liability depends on the interpretation of the individual packer.

The investigators, working under the supervision of Federal-State inspectors, graded the cherries. Federal-State standards were used in determining grades. The data show that the grade of the lug-hauled cherries went down 1.45 percent during transit as compared with 0.04 percent for the water-hauled cherries (table 3.) A relatively small difference in grade can be made up by picking out a greater percentage of defective cherries from the lug-hauled fruit during the sorting which precedes processing. However, to do this takes time and increases costs.

The lug-hauled cherries showed considerably more scald than the water-hauled cherries (table 4). Some of the scald tends to disappear when the fruit is hot-packed. However, as an ever-increasing tonnage is frozen, any method of handling that helps to keep this defect at a minimum is to be desired.

The water-hauled cherries increased in weight during transit, whereas the lug-hauled cherries lost weight (table 5). The lug-hauled cherries increased in weight during the soaking process, whereas the water-hauled cherries remained at about the same weight. In both methods of handling, the cherries lost approximately the same amount of weight during the pitting process. The net result was that the lug-hauled cherries weighed slightly less after pitting than the water-hauled cherries.

Several months after processing, sample cans of fruit were opened and scored by a Federal inspector. As compared with the lug-hauled cherries, the drained weight of the water-hauled cherries was 1.11 percent less and the average score was 0.84 percent more, a slight differential in favor of the water-hauled cherries. All samples of both lug-hauled and water-hauled cherries met legal requirements for drained weight and score for U. S. Grade A pack.

**Labor requirements.**—At the receiving station, about the same amount of labor is required to pour the fruit from lugs into tanks as is required to transfer lugs from the grower's truck to the processor's truck. However, at the processing plant, cherries can be flumed from tanks at the rate of 25,000 pounds per man-hour under favorable conditions (fig. 7), and usually only 1 worker (the truck driver) is necessary. When cherries are handled in lugs with a forklift truck, a truck can seldom be unloaded at a rate exceeding 6,500 pounds per man-hour.

**Lug requirements.**—Approximately 750 lugs would have been required to hold the tonnage of cherries moved in the tank truck used in this study. Ordinarily the processor must make 2 or 3 lugs available for every lug of cherries that a grower harvests in a single day. This means that the tank truck used in this study replaced from 1,200 to 1,500 lugs. At present prices, 1,200 lugs cost approximately $600. The tank that replaced them cost considerably less and will probably last much longer.

To summarize, handling cherries in water at the receiving station:

1. Helps to maintain on-the-tree quality.
2. Reduces costs.
3. Facilitates handling.
4. Reduces the number of lugs required.

Although this system of handling was developed only 3 years ago (1952), processors have been quick to recognize its merits. It is estimated that approximately 25 million pounds of cherries were handled by this method during the 1955 season.

## HANDLING CHERRIES IN WATER—AT THE ORCHARD

The results obtained when cherries were handled in water at the receiving station suggested that perhaps additional advantages could be realized if the cherries were put into water at the orchard immediately after they were picked, rather than later at a receiving station. Such a study was made in 1954.

### Equipment and facilities

In this method of handling, the grower must have truck-mounted tanks of sufficient capacity to handle the crop effectively. In addition to at least one tank truck, he will need an at-the-orchard storage tank or one or more additional tank trucks into which the cherries can be transferred as they come out of the orchard.

The grower also must provide a loading dock in or near the orchard. A water supply of at least 5 gallons per minute should be available at this dock. A sorting table or belt should be provided also. This should be set up in such a way that the cherries pass across it directly into the tank of cold water.

The processing plant must be equipped with a pump of suitable design or a movable flume through which cherries can flow into a boot or other suitable means of unloading. A water supply of at least 20 gallons per minute should be available.

### Procedure

Under normal circumstances, the procedure is as follows: The cherries are picked in 10-quart pails in the conventional manner. The pickers check in their filled pails (usually two at a time) at an assembly point in the picking area and receive "empties" in return. As soon as the filled pails are checked in, a worker loads them onto an orchard trailer. When the trailer is full, it is moved to the loading dock, and loading of a second trailer begins at the assembly point in the picking area.

At the loading dock, the pails of cherries are unloaded from the trailer and, in most instances, they are weighed—usually 15 to 20 pails at a time (see p. 20). Then the cherries are poured onto the sorting table and the empty pails are loaded onto the trailer and returned to the assembly point in the picking area.

*Figure 8.*—Cherries being poured from the picker's pail onto the sorting table, from which they go directly into the water in a tank truck.

As the cherries pass across the sorting table into the tank of cold water, sorters remove any defective fruit (fig. 8). From this point on, the procedure is the same as when the tank is filled at the receiving station. That is, water is circulated through the fruit from bottom to top as the tank is being filled, and the water that overflows at the top carries with it a considerable amount of dirt, leaves, and stems. After filling is completed, circulation of water is continued until the fruit has cooled to a temperature of 60° F. or less. Then the flow of water is cut off, and the water level is lowered to approximately 6 inches below the top level of the fruit to save weight and prevent sloshing on the trip to the processing plant.

When this has been done, the truck driver moves the filled tanker away from the dock, drives a second tank truck into loading position, then returns to the filled truck and starts to the processing plant.

At the plant, the truck driver performs all the work of unloading the truck (fig. 9). He attaches the movable flume to the tank outlet, opens the valve, and directs the auxiliary water supply into the tank. The cherries flow from the tank through the flume into a receiving boot, and move from there to designated soak tanks.

When the tank is empty, he closes the outlet valve and partly refills the tank with cold water for the return trip to the orchard.

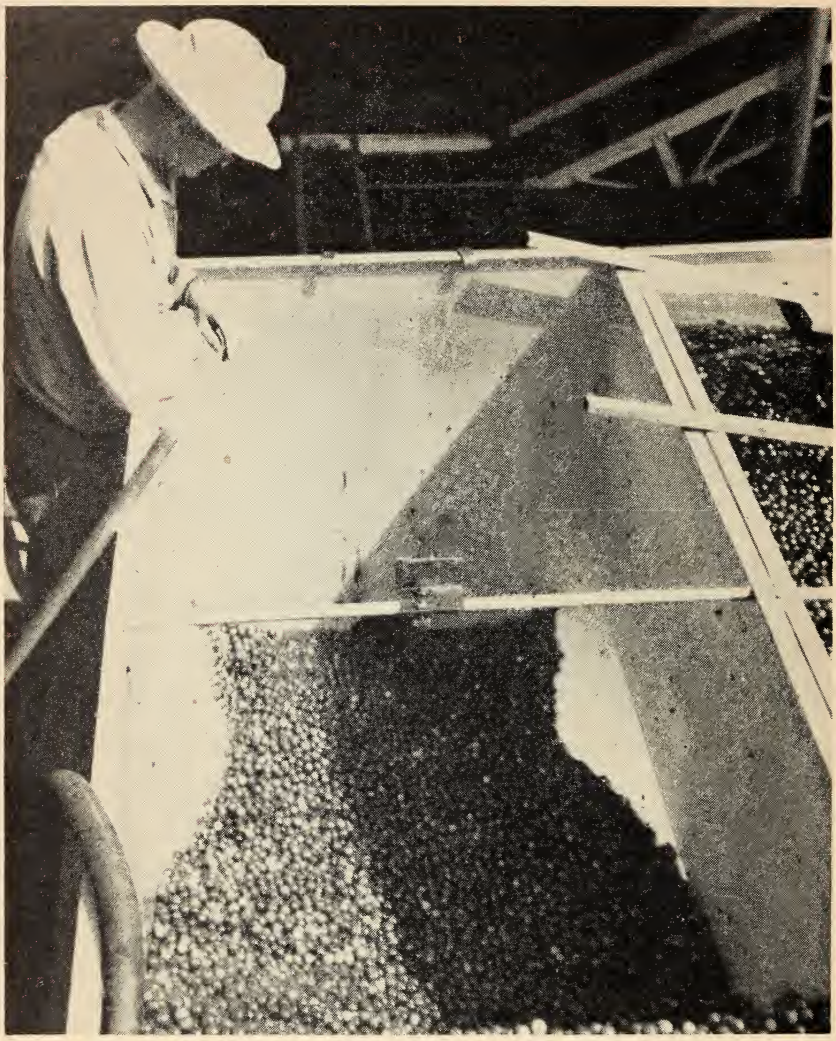

*Figure 9.*—Cherries being flumed out of a tank truck at the processing plant. Only one man is required, and he does comparatively little physical work.

## Results

Operation and cost data were kept on 152 tons of cherries harvested in a 12-day period and handled in water at the orchard. An analysis of the data covering the movement of this crop showed the following results:

**Quality is maintained.**—In order to keep the pickers supplied with pails, it is necessary to empty the filled pails and return them quickly. This means that practically all the cherries are in cold water in less than an hour after they are picked.

The sorting table provides an effective means of removing defective cherries and checking the quality of work done by individual pickers.

The combination of orchard sorting, quick cooling, and water handling is an excellent means of maintaining on-the-tree quality.

A Federal-State inspector graded the cherries that were handled in tanks in this experiment. Of the 66 loads (152 tons) of cherries handled, 13 loads were given a grade of 99 percent; 21 loads, 98 percent; 17 loads, 97 percent; and 15 loads, 96 percent. The average grade of water-hauled cherries was significantly higher than the average grade of comparable lots of lug-hauled cherries. Scald and collapsed cherries were almost completely eliminated in the water-hauled cherries.

**Lugs are eliminated.**—Pouring cherries directly from the picker's pail onto a sorting table, from where they move into tanks, makes the use of lugs unnecessary. The entire 152-ton crop on which detailed records were kept was handled without the use of a single lug.

It was estimated that handling by the conventional method would have required 1,000 to 1,500 lugs. At current prices, the lugs would have cost $500 to $750. The tanks that replaced these lugs cost only $150. Although figures are not available, there is good reason to believe that metal tanks will last much longer and require less maintenance than the easily broken wooden lugs.

**Labor requirements are reduced.**—Handling cherries in water at the orchard reduces the labor requirements for both the grower and the processor. The truck driver unloads the cherries at the processing plant, with no labor expense to the processor. The man who formerly distributed the lugs in the orchard and the man who accompanied the truck driver to the processing plant to help unload the lugs are released for other work.

Inasmuch as the average grade of the water-hauled cherries was higher, they required less sorting than lug-hauled cherries.

**Management is simplified.**—Elimination of lugs simplifies management for both the grower and the processor. In the conventional method of handling, the processor must provide, store, maintain, and distribute hundreds of thousands of lugs. As indicated earlier, in one round trip from orchard to processing plant, a lug is lifted, moved, and stacked from 10 to 12 times, and each lug makes many round trips during the course of a harvest season. Handling cherries in water at the orchard eliminates many troublesome lug-storage, maintenance, distribution, and accounting problems.

Handling cherries by this method makes quality control much easier for the grower. When lugs are filled by the picker, the cherries are seldom inspected until they reach the processing plant, and it is almost impossible for the grower to check the quality of work of the individual picker. When the cherries are poured from the picker's pail onto a sorting table at the loading dock, an accurate check is relatively easy.

If carelessly picked fruit is received at the dock, the checker can be notified, and he can then write the pickers' names or numbers on the pails. When cherries are poured onto the sorting table from these marked pails, pickers whose work is not up to standard can be identified. Thus, the entire harvest operation, including maintenance of quality, can be controlled from the loading dock.

To summarize, handling cherries in water at the orchard has the following advantages as compared with other methods:

1. It is a more effective method of maintaining on-the-tree quality.
2. It is commercially feasible.
3. It eliminates the use of lugs.
4. It benefits both grower and producer.

**Obtaining accurate weights.**—When cherries are handled in lugs, their weight usually is determined on arrival at the processing plant by obtaining the gross weight of the load of filled lugs and then subtracting the weight of the lugs after they have been emptied and weighed back.

When cherries are handled in water, their weight must be determined in some other way. Several satisfactory methods have been developed. The particular method that is used depends on circumstances and the personal preferences of the grower and processor involved. At least one of the following methods should prove satisfactory:

1. In this method, the weight of the cherries is determined at the orchard. An employee, or so-called weighmaster, who is acceptable to both the grower and the processor weighs the filled pails (usually 15 to 20 at a time). After they have been emptied, he weighs the empty pails. The difference between the filled weight and the empty weight is the weight of the cherries. Sometimes the grower and the processor each pay half the weighmaster's salary.

2. In this method, the cherries are also weighed at the orchard by a disinterested party. Several pails of cherries, selected at random from each lot, are weighed to determine the average weight of the cherries in a single pail. Then, the number of pails in the load is multiplied by the average weight of the pails to determine the weight of the load.

3. In this method, the water is drained from the tank of cherries on arrival at the processing plant. The drained fruit is weighed, and 1 percent is subtracted from the drained weight. Experimental work has shown that the water that clings to the fruit accounts for approximately 1 percent of the total weight of the wet cherries.

4. In this method, the cherries are weighed after they are unloaded and drained on a belt or hopper scale at the processing plant, and 1 percent is subtracted from their weight to allow for the water that clings to the fruit.

U. S. GOVERNMENT PRINTING OFFICE: 1956